Drainage Study
for:
Maple Machine Company
~~13000 Highway 57~~ 5218 Agri Ct
Evansville, Indiana

August 31, 1999

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Ind
Agri Steel Subd

Lot 5

DRAINAGE CALCULATIONS FOR MAPLE MACHINE COMPANY
13000 HIGHWAY 57
EVANSVILLE, INDIANA

SITE LOCATION:

The proposed site is lot 5 of Agri-Steel Subdivision, which is located north of Daylight, Indiana. More precisely, the site is located south of Ruston Lane and West of Highway 57.

GENERAL NOTES:

Lots 1 and 7 of Agri-Steel Subdivision have been previously developed, while lots 2 through 6 are vacant. Lot 5 currently has the Maple Machine Company structure under construction. This drainage analysis proposed to provide storm water detention for the undeveloped lots 3 through 6. For purposes of this review, it is assumed that lots 3, 4 and 6 will have similar coverage as lot 5.

EXISTING CONDITIONS:

Previous Use: Agricultural - (site has been allowed to lie fallow for years and is overgrown with brush)

Area Lot 3 : 87,947.64 sf = 2.019 Acres
Area Lot 4: 88, 470.36 sf = 2.031 Acres
Area Lot 5: 96,790.32 sf = 2.222 Acres
Area Lot 6: 114,737.04 sf - 2.634 Acres

Gross Area = 8.906 Acres

EXISTING DRAINAGE PATTERN:

The 4 lots under review are located at the upper end of a larger watershed. These 4 lots drain overland to the south into a poorly defined swale on to the adjacent property. This swale becomes better defined further to the east and eventually becomes an unnamed blueline stream tributary to Bluegrass Creek. Slopes within this site vary from 2 to 5 percent.

Existing Watershed Geometry:

Area: 265,413.5 sf = 8.096 Acres (gross)
Existing Structures = 0 SF
Existing Pavement - 0 SF
Existing Gravel Drive and Parking = insignificant
Existing Agricultural Area = 8.096

Undeveloped Runoff Coefficient, C_u = 0.24 for a fallow field with brush with a slope between 2 and 5% as per Vanderburgh County Drainage Ordinance

$t_c = 0.827\ [n * L / \sqrt{S}]^{0.467}$
L = 1041 feet
H = 23 feet
S = 23/1041 = 0.0220
n = 0.40 from the HERPIC Manual for pasture or average grass

$t_c = 0.827\ [0.40 * 1041 / \sqrt{0.0220}]^{0.467}$
$t_c = 33.7$ minutes

From the Rainfall Intensity as per Vanderburgh County Drainage Ordinance
i = 3.00"/hour for a 10 year storm.

Proposed Watershed Geometry:

Area: 265,413.5 SF = 8.906 Acres (gross)
New Structures = 60,131.53 SF
New Pavement - 63,312.68 SF
Final Green Area = 264,307.17 SF
(The developed areas above were prorated based upon actual proposed coverage for lot 5)

Developed Runoff Coefficient, C_d =

$$\frac{(60,131.53+63312.68 * 0.94)+(264,307.17 * 0.25)}{387,945.36} = 0.47$$

Project: Agri-Steel - Lots 3, 4, 5 and 6
Designer: Easley Engineering
Detention Facility Design Return Period: 25 yrs.
Release Rate Return Period: 10 yrs.
Watershed Area: 8.096 acres
Time of Concentration: 30 minutes
Rainfall Intensity: (i_u) = 3.226
Undeveloped Runoff Coefficient (C_U) = 0.35
Undeveloped Runoff Rate ($O=(C_U)(i_u)(A_u)$ = 0.24 * 3.226 * 8.906 = 6.895 CFS
Developed Runoff Coefficient (C_D)= 0.47

Storm Duration	Rainfall Intensity	Inflow Rate	Outflow Rate	Storage Rate	Required Storage
t_d (hrs)	i_d (in./hr)	$C_d i_d A_D$ (cfs)	$C_u i_u A_u$ (cfs)	$I(t_d)$-O (cfs)	$[I((t_d)$-0 $t_d]/12$ (acre-ft)
0.170	5.925	24.800	6.895	17.905	0.254
0.33	4.571	19.133	6.895	12.238	0.340
0.50	3.646	15.261	6.895	8.366	0.349
0.67	3.123	13.072	6.895	6.177	0.343
0.83	2.601	10.887	6.895	3.992	0.277
1.0	2.078	8.698	6.895	1.803	.0150
1.5	1.739	7.279	6.895	0.384	0.048
2.0	1.40	5.860	6.895	-	-

Peak storage requirement = 0.349 acre-feet = 15,202.44 cubic feet of storage.

Detention will be provided in a dry detention facility located at the southeast corner of lot 3. This detention facility will provide 15,228 cubic feet of storage with a top water elevation of 400.00. The top of berm height will be 401.50 and invert elevation at the point of discharge shall be 397.27

Release will based on the orifice as sized below:

Allowable release = 6.895 cfs

$Q=CA\sqrt{2GH}$
Q = 6.895
A= Area of orifice
C = Coefficient = 0.63
G = Gravity = 32.2 ft/sec^2
H = Head = 400-397.27 = 2.73"

$6.895 = 0.63 * A \sqrt{2} * 32.2 * 2.730$

Area of orifice = 0.825 SF = πr^2

r = 0.513' = 6.15"

Provide a 12" RCP as the release structure.

Release for the 100 year event is provided by an earthen weir in the berm as detailed.

A 100 year overflow weir will be provided to discharge the 100 year event based upon the following:

i_{100} =4.608
Area = 8.906
c = 0.47

$Q_{100} = 0.47 * 4.608 * 8.906 = 19.288$ cfs

Weir shall be 7.2 feet wide with a one foot operating head with an additional half foot of free board,

Computer generated weir design is attached as part of this analysis.

C:\Projects\WPDOCS\6600.DRG.wpd

WEIRS

Enter up to 10 weirs.
Enter <Return> only for flowrate and length to end.

FLOWRATE (CFS)	LENGTH (FT)	COEFF (-)	HEAD (FT)
19.29	7.2	2.680	1.00

<Shift> <Prt Sc> print <Return> repeat <Space Bar> back to menu

STORM SEWER DESIGN SHEET - RATIONAL METHOD

PROJECT: AGRI-STEEL LOTS 3 THRU 6 DATE: AUG 8, 99 SHEET: 1 OF 1

ENGINEER: EASLEY ENGINEERING, INC. DESIGN STORM: 25 YR MANNINGS N: 0.013

Line Number	Upstream Manhole	Downstream Manhole	Length (Ft)	C_j	A_j (Acres)	C_jA_j	ΣC_jA_j	t_j (min)	t_{cum} (min)	i (in/hr)	Q (CFS)	Pipe Diameter (in)	Pipe Slope (%)	Pipe Capacity (CFS)	Velocity (Ft/Sec)	Travel Time (min)	Rim Elevation Upstream	Rim Elevation Downstream	Invert Elevation Upstream	Invert Elevation Downstream	Pipe Cover Upstream	Pipe Cover Downstream
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
9	109	104	185	0.47	0.72	0.34	0.339	15	15	5.033	1.71	12	4.56	7.61	6.67	0.462	413.5	410.5	409	400.53	3.5	
						0	0.339															
8	107	106	104	0.47	1.72	0.81	1.147	15	15	5.03	5.77	18	0.63	8.3	4.29	0.4	405.5	412.75	402.5	401.85	1.25	9.15
7	106	105	156	0.95	0.06	0.06	1.204	15	15.4	5.03	6.06	18	0.63	8.3	4.34	0.59	412.75	409.5	401.85	400.87	9.15	6.88
6	105	104	54	0.47	1.57	0.74	1.942	15	16	5.03	9.77	21	0.63	12.53	4.89	0.18	409.5	410.5	400.87	400.54	6.88	7.96
5	104	103	207	0.47	0.91	0.43	2.37	15	16.2	5.03	11.9	21	0.63	12.53	5.14	0.67	410.5	405.75	400.54	399.24	7.96	4.51
4	103	102	30	0.47	0.91	0.43	2.797	15	16.8	5.03	14.1	24	0.63	17.88	5.36	0.09	405.75	404.6	399.24	399.06	4.51	3.29
3	102	101	223	0.47	0	0	2.797	15	17	*	14.1	24	0.63	17.88	5.36	0.69	404.6	400.16	399.06	397.66	3.29	0.75